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MANAGEMENT AND COMPARATIVE EFFICACY OF VARIOUS TREATMENTS AGAINST *ERIOSOMA LANIGERUM* HAUSMANN ON APPLE TREES (*MALUS DOMESTICA* BORKH.) IN JAMMU PROVINCE OF JAMMU & KASHMIR STATE

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ABSTRACT
Data on Management of woolly apple aphids was recorded in District Doda of Jammu province during 2010-2011. For the control of aphid population, efficacy of four insecticides viz. Phosphamidon, Chlorpyrifos, Fenitrothion and Fenvalerate at recommended doses of 0.03%, 0.05%, 0.05% and 0.01%, and a control with water treatment were tested. Each treatment was replicated thrice and a single plant served as a single unit of replication. Pre treatment observation on the pest population was recorded one day before the treatments. The post treatment observations were recorded at 3, 10 and 30 days after treatment.

KEY WORDS: Management, comparative efficacy, *Eriosoma lanigerum*, Phosphamidon, Chlorpyrifos, Fenitrothion and Fenvalerate

INTRODUCTION

Woolly apple aphid, *Eriosoma lanigerum* Hausmann (Hemiptera Aphididae) infests aerial and subterranean parts of the apple trees. Once established, its control is difficult because of fast rate of parthenogenetic reproduction and coverage of the body by a waxy flocculence. Efforts have been going on across the world for combating this insect pest menace for quite long and the stage has now reached when the various promising alternatives to the erstwhile dependable control measures through systematic pesticides are at the disposal with lot of potential. In the recent past emphasis was given to the insect pest management measures which are scientifically sound, environmentally safe and economically feasible. Natural enemies however exercise a good degree of control aerial populations of woolly apple aphid. In 1937, attempts were made to introduce and establish exotic parasitoid, *Aphelinus mali* (Haldeman) from U.K in Kullu valley where it established successfully within a short time and provided upto 98% control (Rahman and Khan, 1941). Later the parasitoid was also introduced at Chaubattia (Uttaranchal), Coimbatore (Tamil Nadu) and Shillong (Meghalaya) where it provided significant control in aphid multiplication in initial stages but later failed to establish due to varied climatic conditions (Cherian, 1942; Lal and Singh, 1947, Chacko, 1967). The indiscriminate use of most toxic insecticides and changes in agro climatic conditions led to poor establishment of the parasitoid in apple orchards (Adlakha and Hameed, 1972). Various predators which have been reported to exercise fairly good control over woolly apple aphids include *coccinela septempunctata* (Lal and Singh, 1945, 1947; Singh, 1942), *Chilomenus bijugus Muslant, Balia ancharis, Coelophora sanzeti, Syrphus confractor, Conioxomposa indica, Ancylopteryx punctata Hay, Exochomus uropycgialis* and Syrphus (Rahman and Khan, 1941; Lal and Singh, 1947; Zaku ru Rab, 1972;). Chakrabarti *et al.* (1988) reported Harmonia dimidiata, a voracious predator, which consumed 853.7 and 710.7 individuals of woolly apple aphids at 24 and 17.6° C respectively. The introduced parasitoid, *Aphelinus mali* (Haldeman) and other natural enemies put some constraint on growth of its population in the mid hills (Rawat and Pawar, 1987; Gupta and Chander, 1992; Thakur et al. (1992) but failed to take care of subterranean population and consequently the pest continue existing through up and down movements on the trees (Thakur et al. (1992). In India attempts have been made earlier to control woolly apple aphis by aerial application of insecticides in recommended doses (Gupta et al., 1969; Hameed et al. (1974; Thakur and Gupta, 1998) and by soil application of granules (Attri and Sharma, 1971). Woolly apple aphid has potential of rapid genetic change, completing multiple generations per year. As different classes of chemicals have come into use, the aphid has changed from a rare resident of orchards to a severe pest (Asante, 1997). With time, woolly apple aphid and its natural enemies adapted to new chemical environments at different rates. For example, in 1946 DDT began to interfere with the parasitoid in Washington, causing outbreaks of woolly apple aphids. By 1952, *Aphelinus Mali* developed some resistance to DDT and parasitism increased in general (Johansen, 1957). Wooly apple aphids have been susceptible to organophosphates and carbamates. These compounds are still in use in some parts of the world (Chander and Dogra, 1977; Penman and Chapman, 1979, Klostermeyer and Williams, 1982; Beers et al., 2002; Hogmire and Brown, 2001).

MATERIALS & METHODS

Experiments for management of wooly apple aphid infestation on apple trees were carried out at Bhaderwah Station, in a completely randomized block design during 2010-2011. For the control of aphid population, efficacy of four insecticides viz. Phosphamidon, Chlorpyrifos, Fenitrothion and Fenvalerate at recommended doses of 0.03%, 0.05%, 0.05% and 0.01%, and a control with water treatment were tested. Each treatment was replicated thrice and a single plant served as a single unit of replication. Pre-treatment observation on the pest population was recorded one day before the treatments. The post treatment observations were recorded at 3, 10 and 30 days after treatment and the data was analyzed statistically after square root transformation.

RESULT & DISCUSSION

Efficacy of four insecticides viz. Phosphamidon, Chlorpyrifos, Fenitrothion and Fenvalerate at recommended doses of 0.03%, 0.05%, 0.05% and 0.01%, and a control with water treatment were tested for woolly apple aphids. Data on bio efficacy of different treatments against wooly apple aphids is presented in Table-1. Each treatment was replicated thrice and a single plant served as a single unit of replication. Pre treatment observation on the pest population was recorded one day before the treatments. The post treatment observations were recorded at 3, 10 and 30 days after treatment. Data revealed that Fenitrothion @0.05% gave hundred percent success in controlling woolly apple aphid colonies followed by phosphamidon (0.03%), chlorpyrifos (0.05%) and then Fenvalerate (0.01%) upto 30 days after treatment of the chemicals. However Chlorpyrifos (0.05%) and phosphamidon (0.03%) also offered good resistance over the pest 3 days after the treatment by reducing aphid colonies upto 93.18% and 80.28% respectively which increased considerably during 10 and 30 days after treatment and finally led to a tremendous control of aphid colonies upto 96.23% and 91.55% respectively. On the other hand fenvalerate (0.01%) showed maximum control (30.14%) during 3rd day after treatment, which decreased to 21.47% and 12.37% during 10th and 30th days after treatment of chemicals. Among all the insecticides tested on the basis of overall effectiveness, fenitrothion (0.05%) suppressed 100 percent control of aphid colonies upto 30 days after treatment and was thus a promising pesticide for pest management. Hameed *et al.* (1974) and Thakur and Gupta (1998) recorded that phosphamidon (0.03%) was most effective in controlling woolly apple aphid populations in Himachal Pradesh. Similarly the effect of chemicals viz. Chlorpyrifos (0.05%), Fenitrothion (0.05%) and fenvalerate (0.01%) has already been evaluated by Thakur and Gupta (1998). They revealed that Chlorpyrifos (0.05%), and Fenitrothion (0.05%) provide good control of woolly apple aphids for 30 days. In view of the fact that Chlorpyrifos (0.05%) and Fenitrothion (0.05%) have been reported effective against other insect pests of apples like sanjose scale and thrips (Thakur and Dogra, 1980; Bower, 1987; Bhardwaj, 1988) and are readily available in the market, they can be recommended for use on severely infested trees during September when biotic agent activity remains low. Penman and Chapman (1980) reported woolly apple aphids to be highly susceptible to foliar application of chlorpyrifos (0.05%). Also in Poland, chlorpyrifos (0.1%) and demeton S methyl (0.05%) were reported to give good control of aerial population of woolly apple population (Badowaska and Pala, 1990). Hansen (1975) reported food control of woolly apple aphid in Denmark with a relatively higher concentration of fenitrothion (0.075%). Thakur and Gupta (1998) also recorded earlier that fenvalerate @ 0.01% failed to give satisfactory control of the aphids which is in accordance with the findings of present author in Jammu Province. Results on bio-efficacy of different insecticides revealed that all the treatments gave a significant control of the pest upto 30 days after treatment against control. Fenitrothion @ 0.05% gave hundred percent success in controlling woolly apple aphid colonies followed by phosphamidon (0.03%), chlorpyrifos (0.05%) and then Fenvalerate (0.01%) upto 30 days after treatment of the chemicals.

TABLE 1: Comparative efficacy of various treatments against *Eriosoma lanigerum* Hausmann on apple trees (*Malus domestica* Borkh.) during 2010 and 2011

Treatment	Dose/ plant	Pre treatment count	Average percent reduction in the number of aphid colonies (Days after treatment)			Pooled mean
		2010-11	3	10	30	
Phosphamidon	0.03%	28.66 (5.44)	$93.18^{a} \pm 1.02$ (9.70)	$99.60^{a} \pm 0.40$ (10.02)	$99.60^{a} \pm 0.40$ (10.02)	$96.23^{a} \pm 1.52$ (9.86)
Chlorpyrifos	0.05%	36.58 (6.13)	$80.28^{b} \pm 4.70$ (9.01)	$98.55^{a} \pm 0.85$ (9.97)	$98.55^{a} \pm 0.85$ (9.97)	$91.55^{a} \pm 3.6$ (9.62)
Fenitrothion	0.05%	29.33 (5.50)	$100.00^{a} \pm 0.0$ (10.04)	$100.00^{a} \pm 0.0$ (10.04)	$100.00^{a} \pm 0.0$ (10.04)	$100.0^{a} \pm 0.0$ (10.04)
Fenvalerate	0.01%	29.49 (5.52)	$30.14^{c} \pm 4.26$ (5.58)	$12.37^{b} \pm 3.3$ (3.65)	$12.37^{b} \pm 3.3$ (3.65)	$21.60^{b} \pm 3.5$ (4.75)
Control (water)	100%	45.75 (6.83)	$13.13^{d} \pm 0.57$ (3.75)	$0.00^{c} \pm 0.0$ (1.00)	$0.00^{c} \pm 0.0$ (1.00)	$8.75^{c} \pm 0.41$ (3.12)

*Average of three replications

Figure in parenthesis are √n+1 transformed values and means followed by same superscripts have no significant difference

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